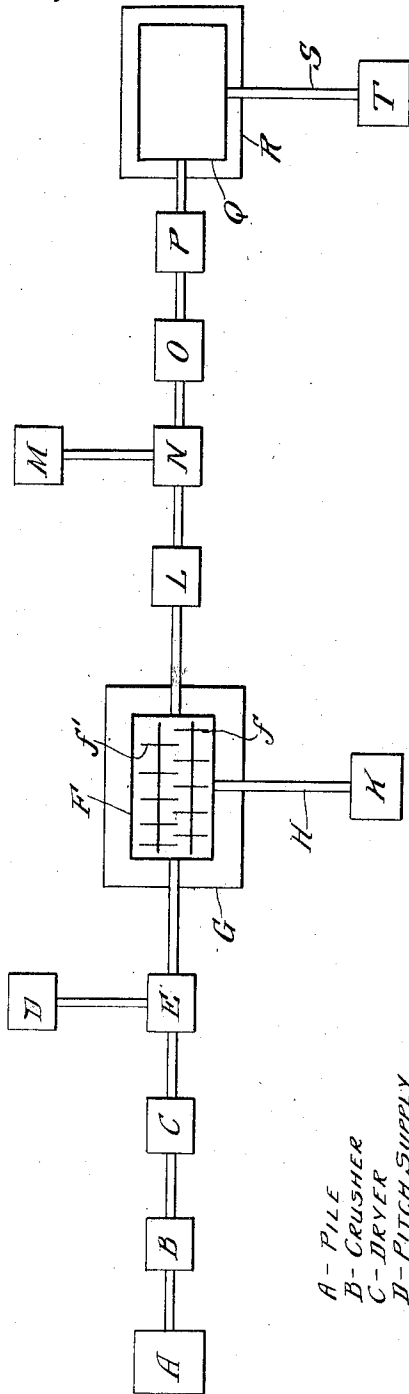


W. RUNGE.
TREATING OF LIGNITE.
APPLICATION FILED APR. 30, 1919.

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- A - PILE
- B - CRUSHER
- C - DRYER
- D - PITCH SUPPLY
- E - MIXER
- F - RETORT
- G - FURNACE RETORT
- H - MIXING AND CONVEYING MEANS
- I - DISTILLED GAS PIPE
- J - EXHAUSTER
- K - CRUSHER
- L - PITCH SUPPLY
- M - MIXER
- N - FLUXING APPARATUS
- O - BRIQUETTING APPARATUS
- P - RETORT
- Q - FURNACE RETORT
- R - GAS PIPING
- S - EXHAUSTER
- T - EXHAUSTER

INVENTOR

Walter Runge.

BY

Riddle & Margeson.

ATTORNEYS

UNITED STATES PATENT OFFICE.

WALTER RUNGE, OF ORANGE, NEW JERSEY, ASSIGNOR TO INTERNATIONAL COAL PRODUCTS CORPORATION, OF RICHMOND, VIRGINIA, A CORPORATION OF VIRGINIA.

TREATING OF LIGNITE.

1,334,170.

Specification of Letters Patent.

Patented Mar. 16, 1920.

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To all whom it may concern:

Be it known that I, WALTER RUNGE, a citizen of the United States, and a resident of Orange, in the county of Essex and State of New Jersey, have made certain new and useful Improvements in the Treating of Lignites, of which the following is a specification.

The invention has in view the treating of lignite and certain bituminous coals and particularly involves the adding pitch thereto or mixing therewith prior to subjecting the lignite or the coal having the pitch to a partial carbonization or partial distilling operation in a retort wherein the lignite, viz. the mixture, is only partially carbonized.

The pitch thus added, prior to the carbonizing operation previously referred to and which may be considered as an initial or primary carbonization, leads to an improving of the coking qualities of the lignite or coal, and according to a more specific aspect of the invention the residue or partially carbonized mixture is crushed, more pitch is added thereto, a fluxing operation is then performed, followed by a briqueting of the fluxed mixture, and a final or second carbonization is carried out at a temperature higher than that of the first carbonization.

The invention is particularly concerned with the manufacture from lignite of a carbonized fuel, preferably in the form of carbonized briquets made by a process which includes the mixing of pitch with the lignite, when dry, the effecting of a partial carbonization, the crushing of the residue resulting from this carbonization, the mixing with the crushed residue of pitch, and the forming of the desired carbonized fuel therefrom by a series of steps which includes a second carbonization.

The invention also, in the broader aspect, relates to the manufacture of the mixture which includes the partially carbonized residue and the pitch, to the raw briquets which may be made therefrom, and also to the carbonized fuel made from this mixture.

A specific manner in which the invention may be realized is hereinafter set forth in detail and the description is amplified by

reference to the accompanying drawing, forming a part of this specification, in the sole figure of which the steps of the specific process and the apparatus for performing the same are diagrammatically illustrated.

In performing one of the specific processes, the lignite is taken from the pile A, is conveyed to the crusher B and there crushed into finely divided form. Thereafter, the crushed material is conveyed to drier C where substantially all of the moisture in the lignite is removed—as far as it is practical to remove the moisture.

Pitch, such as coal tar pitch—water gas tar pitch or even other pitch—in crushed or liquid form is conveyed from the source of supply D to the place, designated by E, where the pitch and crushed lignite are intermittently mixed; thereafter the mixture of dry lignite and pitch is conveyed to the interior of the retort F of the furnace retort G. A lignite which has been used herein is one having forty-five per cent. (45%) volatile matter therein and the amount of pitch added at the point E and found to produce satisfactory results is ten per cent. (10%) of the resulting mixture; in other words, say ninety per cent. (90%) crushed lignite of forty-five per cent. (45%) volatile and ten per cent. (10%) coal tar pitch (dry basis of lignite).

The retort is exteriorly heated and has therein mixing and conveying means indicated by *f f'*, the function of which means is to constantly agitate or mix the material within the retort and to convey the material being treated from the charging end of the retort toward the discharging end thereof, whereby the material will be progressively and uniformly heated throughout. The mixed material within the retort is subjected to a heat treatment; in other words, to a distillation or carbonizing operation that is carried out in a manner to distil from the material within the retort—that is from the pitch and the crushed lignite—a substantial portion of the volatile matter therein, to wit, the hydrocarbon volatile matter, and in a manner to leave a uniform but partially distilled lignite or residue. The temperature at which this heating is performed is ap-

proximately between 800 degrees F and 900 degrees F., more specifically approximately 825 degrees F., although the temperature may be somewhat varied. The vapors or gases distilled off during the carbonizing are withdrawn as made, through piping H leading from the retort to an exhauster K, and the vapors and gases passing through the exhauster are subsequently collected.

10 The heating carried out in the retort F is frequently referred to as the preliminary heating or initial carbonizing in order to distinguish it from another heating or carbonizing hereinafter referred to as the second or final carbonization. The furnace retort G, of which the retort F is a part, is frequently referred to as the primary furnace or primary retort. The percentage of volatile matter in the partially carbonized residue may vary somewhat—sometimes it may be reduced as low as seven per cent. (7%) or may be left as high as fourteen per cent. (14%). I have found, however, that it is practical to have the residue leave the primary retort with approximately twelve per cent. (12%) of volatile matter therein, when the residue is from the particular lignite above referred to.

30 The partially carbonized residue is conveyed from the primary retort to a crusher L where it is rendered in finely divided form. Pitch is conveyed from the source of supply M to the place, as N, where the pitch is added to the crushed residue. This pitch is thoroughly mixed with the crushed residue and the mixture is fluxed in the fluxing apparatus O. The fluxing apparatus is relied upon to perform the well known fluxing and to effect the desired uniform mixing of the pitch and partially carbonized residue. When the mixture is properly fluxed it is then conveyed to a briquetting apparatus, as P, and the briquets resulting from the briquetting operation are finally conveyed to the retort or oven Q of the furnace retort R. This retort or oven Q is exteriorly heated and the gases and vapors given off during this heating are conveyed from the interior of retort R by piping S leading from the interior of the retort to exhauster T; these gases and vapors are thereafter finally collected.

50 The heating which is performed in the retort or oven Q is frequently referred to as the second or final carbonization and the furnace of which this retort is a part is frequently referred to as the secondary furnace. In the retort of this secondary furnace the carbonizing operation is carried out at temperatures approximating 1400 degrees F. or upward, preferably at a temperature approximating 1850 degrees F., and at this high temperature or temperatures there are developed the cementing qualities of the

binding material in the mixture, to wit, the mixture of which the briquets are made, whereby there result briquets having a firm coherent structure. These carbonized briquets are the same shape as the raw briquets from which they were made but they are somewhat smaller in size, due to a shrinking which takes place during the carbonizing operation. The volatile matter in the carbonized briquets is approximately one per cent. (1%) to four per cent. (4%).

75 I find that a mixture satisfactory for making briquets is one which includes, for example, eighty-five per cent. (85%) or ninety per cent. (90%) of the partially carbonized residue having ten per cent. (10%) to twelve per cent. (12%) volatile matter therein and ten per cent. (10%) or fifteen per cent. (15%) of pitch—for example, coal tar pitch—when mixed and fluxed as herein outlined.

85 The invention, as previously indicated, involves the making of a mixture of raw lignite and pitch, the partial carbonizing of this mixture, the making of briquets from the partially carbonized material or residue, and the carbonizing of the briquets thus made. In another aspect it would include the making of a suitable fuel by any process employing the carbonizing of the mixture of pitch with a crushed residue from a partial carbonization of a mixture of raw lignite and pitch.

95 The invention, in still another aspect, contemplates the partial carbonizing of a mixture of raw lignite and pitch and the crushing of the partially carbonized residue; it also contemplates the mixing with such crushed residue the pitch; also the fluxing of the crushed residue, whether or not pitch has been added thereto; also the briquetting of the fluxed material and the carbonizing of the crushed partially carbonized material and pitch, and particularly when in briquet form.

110 It has been found that if an attempt is made to briquet some lignites by carbonizing the raw lignite—without first adding pitch thereto—by subsequently making briquets from the resulting partially carbonized lignite, and by carbonizing these briquets, the resulting carbonized briquets will not have a firm, coherent structure and will not withstand rough handling or use. On the other hand, if pitch is mixed with the same raw lignite, prior to the initial partial carbonization, and briquets are made from the partially distilled residue resulting from the carbonizing of such mixture and by subjecting the briquets thus made to a final carbonizing operation, the resulting carbonized briquets can be made so as to have a firm, coherent structure and so that they will withstand rough, hard usage. Just what

function the adding of the pitch to the raw lignite, prior to the initial carbonizing, performs is difficult to describe, but it seems to increase the coking qualities of the lignite.

5 At any rate, it enables the making of a carbonized briquet with a firm, coherent structure in a manner it is not possible to make the briquet if pitch is not added at said time.

10 The word "lignite" as used herein is also to be construed to cover other carbonaceous substances, such as certain bituminous coals that will respond to the treatment herein outlined.

15 It will also be manifest that the invention is not limited to a lignite having the particular volatile matter herein specified and that the process is not necessarily limited to the producing of a partially distilled residue having the volatile matter therein of the amount herein indicated. It will also be evident that the percentage of pitch added may vary according to different conditions and to the type of coal treated; however, for any particular lignite or coal a practical method is readily determinable.

25 The temperature herein indicated may also be varied within reasonable limits without departing from the spirit and scope of the invention. The heating which is carried out in the primary furnace or retort may be referred to as a low temperature distillation or low temperature carbonization, while that carried out in the secondary furnace or retort may be referred to as a high temperature distillation or high temperature carbonization.

What I claim is:—

40 1. In the manufacture of briquets the method which comprises mixing pitch with lignite, partially carbonizing the mixture, crushing the residue resulting from said carbonizing, forming briquets therefrom, and carbonizing the briquets.

45 2. In the manufacture of briquets the method which comprises partially carbonizing a mixture of lignite and pitch, crushing the residue resulting from the carbonizing, adding pitch to the crushed residue and fluxing the mixture last resulting, and thereafter forming and carbonizing briquets.

50 3. In the manufacture of briquets the method which comprises mixing pitch with lignite, partially carbonizing the mixture, crushing the residue resulting from the carbonizing, fluxing the crushed residue, forming briquets from the fluxed material, and carbonizing the briquets.

60 4. The method of manufacturing briquets which comprises crushing lignite and mixing pitch therewith until the pitch in the mixture approximates from ten per cent. (10%) to fifteen per cent. (15%), subject-

ing the mixture to a carbonizing operation 65 until there is produced a residue partially carbonized and with volatile matter therein, crushing the residue, mixing pitch therewith until the pitch approximates ten per cent. (10%) of the mixture and fluxing the mixture, 70 briqueting the fluxed mixture, and subjecting the resulting briquets to a carbonizing operation at a temperature approximating 1850 degrees F.

5. The method of manufacturing briquets 75 which comprises crushing lignite and mixing therewith pitch approximating from ten per cent. (10%) to fifteen per cent. (15%) of the mixture, subjecting the mixture to a carbonizing operation at temperatures approximating 800 degrees F. to 900 80 degrees F. and until there is produced a residue partially carbonized and having approximately fourteen per cent. (14%) to seven per cent. (7%) volatile matter therein, 85 crushing the residue, mixing therewith pitch approximating from ten per cent. (10%) to fifteen per cent. (15%) of the mixture resulting from the adding of the pitch, fluxing the mixture, thereafter briqueting, and finally 90 subjecting the resulting briquets to a carbonizing operation at temperatures of upward of 1400 degrees F.

6. The method of manufacturing briquets 95 which comprises crushing lignite and mixing therewith, when the lignite is dry, pitch until the pitch approximates from ten per cent. (10%) to fifteen per cent. (15%) of the mixture, subjecting the mixture to a carbonizing operation until there is produced a partially carbonized residue having 100 volatile matter therein, crushing the residue, mixing therewith until the pitch approximates ten per cent. (10%) of the mixture and fluxing the mixture, thereafter briqueting, 105 and subsequently carbonizing the briquets.

7. In the manufacture of briquets the method which comprises mixing pitch with lignite in finely divided form until the pitch 110 approximates from ten per cent. (10%) to fifteen per cent. (15%) of the mixture, subjecting the mixture to a carbonizing operation until a substantial portion of the volatile content of the lignite is distilled therefrom, 115 mixing pitch with the partially carbonized residue until the pitch approximates ten per cent. (10%) of the mixture, and forming the mixture into fuel of character and size suitable for domestic use by a process which includes carbonizing at a 120 temperature of upward of 1400 degrees F.

8. In the manufacture of briquets the method which comprises mixing coal tar pitch with lignite, subjecting the mixture 125 to a carbonizing operation until a substantial portion of the volatile content of the lignite is distilled therefrom, mixing coal

tar pitch with the partially carbonized residue and fluxing, and forming the fluxed mixture into a fuel by a process which includes further carbonizing.

5 9. In the manufacture of briquets the method which comprises mixing pitch with lignite or bituminous coal, subjecting the mixture to a low temperature carbonizing operation until a substantial portion of the
10 hydrocarbon volatile content of the lignite or coal is distilled therefrom, mixing pitch with the partially carbonized residue, and forming the mixture into a fuel by a process which includes a high temperature carbon-
15 izing operation.

10 10. In the manufacture of fuel suitable for domestic use the mixing of pitch with lignite, subjecting said mixture to a carbonizing operation at approximately 800 de-
20 grees F. to 900 degrees F. and in a manner to partially carbonize the lignite, withdrawing and collecting vapors and gases driven off during said carbonizing operation, crush-
25 ing the partially carbonized residue, fluxing, and subsequently forming the desired fuel from the fluxed material by a process which includes carbonizing upward of 1400 de-
30 grees F.

30 11. In the manufacture of fuel suitable for domestic use the mixing of pitch with lignite or bituminous coal when the lignite or coal is in finely divided form, subjecting said mixture to a carbonizing operation at approximately 800 degrees F. to 900 degrees
35 F. and in a manner to partially carbonize the lignite or coal, withdrawing and collecting vapors and gases driven off during said carbonizing operation, crushing the partially carbonized residue, adding pitch
40 thereto and fluxing, and subsequently forming the desired fuel by a process which includes carbonizing at a temperature or temperatures of upward 1400 degrees F.

45 12. In the manufacture of fuel suitable for domestic use the mixing of pitch with finely divided lignite, subjecting the mixture to a carbonizing operation at approximately 800 degrees F. to 900 degrees F. and in a manner to partially carbonize the lignite, withdraw-
50 ing and collecting vapors and gases driven off during said carbonizing operation, crushing the partially carbonized residue, adding pitch thereto and fluxing, and subsequently forming from the fluxed material the desired
55 fuel by a process which includes carbonizing at 1850 degrees F.

60 13. The method which comprises partially carbonizing a mixture of lignite and pitch, crushing the residue, adding thereto pitch, and carbonizing in a manner to produce material having a firm structure.

14. The method which comprises partially carbonizing a mixture of lignite and pitch, crushing the residue, adding thereto pitch,

briquetting, and subsequently carbonizing in 65 a manner to produce a firm structure.

15. The method which comprises partially carbonizing a mixture of lignite and pitch, crushing the residue, adding thereto pitch, fluxing, briquetting, and carbonizing the
70 briquets in a manner to develop a firm, coherent structure.

16. In the treating of lignite and the forming of a fuel therefrom the method which comprises crushing lignite, mixing
75 with the crushed lignite a substantial amount of pitch or other hydrocarbon material in liquid or semi-liquid condition, heating the mixture in a retort to partially distil the volatile therein, withdrawing the residue
80 from the retort, adding thereto pitch or other hydrocarbon material, and subjecting the fluxed material to a final carbonization in a retort and at approximately 1850 de-
85 grees F.

17. In the treating of lignite and the forming of a manufactured fuel therefrom the method which comprises crushing the lignite, adding to and mixing with the
90 crushed lignite a substantial amount of pitch or other hydrocarbon material, heating the mixture in a retort in a manner to distil from the mixture a portion of the hydrocar-
95 bon volatiles therein, withdrawing the residue from the retort, adding thereto pitch or other hydrocarbon material and suitably fluxing, and thereafter subjecting the fluxed material to a final carbonization in a retort
100 and at temperatures upward of 1400 de-
105 grees F.

18. In the treating of lignite and the forming of a manufactured fuel therefrom the method which comprises crushing lig-
110 nite, adding to and mixing with the crushed lignite a substantial amount of coal tar pitch, heating the mixture in a retort in a manner to partially distil the hydrocarbon volatile therein, withdrawing the residue
115 from the retort, adding thereto coal tar pitch, fluxing, and thereafter subjecting the
120 fluxed material to a final carbonization in a retort and at temperatures approximating 1850 degrees F.

19. The method which comprises heating lignite in a manner to dry the same, mixing
125 pitch with the dried lignite, inserting said mixture into a retort and subjecting the mixture therein to a carbonizing operation in a manner to produce a partially carbon-
130 ized residue while withdrawing from the retort the vapors and gases produced during the carbonizing operation, crushing said residue and mixing therewith pitch.

20. The method which comprises heating lignite in a manner to dry the same, mixing
135 pitch with the dried lignite, inserting said mixture into a retort and subjecting the mixture therein to a carbonizing operation in

a manner to produce a partially carbonized residue while withdrawing from the retort the vapors and gases produced during the carbonizing operation, crushing said residue, 5 mixing therewith pitch, and fluxing the mixture.

21. In the manufacture of fuel the method which comprises crushing and drying lignite, mixing with the dried lignite ten per cent. (10%) to fifteen per cent. (15%) coal 10 tar pitch, inserting said mixture into a retort, subjecting the mixture therein to a carbonizing operation at a temperature of approximately 825 degrees F. in a manner to 15 produce a partially carbonized residue while withdrawing from the retort the vapors and gases produced during the carbonizing operation and collecting the withdrawn vapors and gases, crushing said residue, adding 20 thereto coal tar pitch and fluxing, thereafter forming the fluxed mixture into briquets and carbonizing said briquets at 1750 degrees F. and upward within retorts, from which retorts the gases and vapors which are driven 25 off during said carbonizing operation are withdrawn and collected.

22. The method which comprises drying lignite, mixing pitch with the dried lignite, 30 subjecting the mixture to a carbonizing operation in a manner to produce a partially carbonized residue, crushing said residue,

adding thereto pitch, fluxing, and briqueting the fluxed mixture.

23. An article of manufacture made by 35 mixing dry, raw lignite and pitch, by partially carbonizing the mixture, and by crushing the resulting residue.

24. A product made by mixing raw lignite or raw coal with pitch, by partially carbon- 40 izing the mixture, by crushing the residue, and by adding pitch to the crushed residue.

25. A product made by mixing raw lignite or raw coal with pitch, by partially carbon- 45 izing the mixture, by crushing the residue, by adding pitch to the crushed residue, and by fluxing the mixture of crushed residue and added pitch.

26. A briquet made by adding pitch to raw lignite or raw bituminous coal, by par- 50 tially carbonizing the mixture, by crushing the partially carbonized residue, mixing pitch with the crushed residue, by fluxing the mixture of pitch and crushed residue, and by briqueting the fluxed mixture. 55

27. The method which comprises partially carbonizing a mixture of raw lignite and pitch.

28. The product made by partially carbon- 60 izing a mixture of raw lignite and pitch.

This specification signed this 23rd day of April, A. D. 1919.

WALTER RUNGE.